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(54) Title: IMPROVED OXYGEN BLEACHING SYSTEM (57) Abstract The present invention relates to a method for providing a plurality of separate chambers to make and use an activated bleach mixture. The separate chambers include an aqueous component chamber which has from about 10 % to about 90 % moisture and an aqueous component, and a non-aqueous component chamber which has a non-aqueous solvent and a non-aqueous component. The separate chambers maintain the contents of the aqueous component chamber and the non-aqueous component chamber in a substantially unmixed state. Also provided is an alkalinity source. An activated bleach mixture is made by commingling the contents of the aqueous component chamber, the non-aqueous component chamber, and the alkalinity source. This forms an activated bleach mixture having an available peroxyacid oxygen level of at least about 200 ppm. The activated bleach mixture can then be used in a cleaning application. The current invention also provides for a kit for making and using an activated bleach mixture.		

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IMPROVED OXYGEN BLEACHING SYSTEM

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FIELD

The present invention relates to methods for making and using oxygen bleaches. Specifically, the present invention relates to methods for making and using oxygen bleaching systems in cleaning compositions, and a kit for making such oxygen bleaching systems.

BACKGROUND

Bleaching agents are highly desired in cleaning compositions because they provide improved whitening and cleaning. In particular, consumers desire oxygen bleaches, because they are generally safe on fibers and fabrics, as well as hard surfaces. They are compatible with enzymes present in cleaning compositions, tend not to damage colored and/or brightly dyed fabrics, and do not damage fabric if there is accidental overuse of the oxygen bleach. The cleaning and bleaching efficacy of bleaching agents, and in particular oxygen bleaches, can be significantly increased by combining a bleach activator with the bleaching agent. Therefore, oxygen bleaches often consist of at least an active oxygen source and a bleach activator. In the presence of an alkalinity source and moisture, these active oxygen sources and bleach activators evolve available peroxyacid oxygen. While not intending to be limited by theory, it is believed that it is the production of this available peroxyacid oxygen which provides effective oxygen bleaching activity.

Liquid, gel, and paste cleaning compositions containing oxygen bleaches are known in the art. Non-granular cleaning compositions are sometimes preferred over granular detergents, because they have good dispersion and solubility in the wash solution. The active oxygen source and/or the bleach activator contained in these non-granular cleaning compositions can sometimes degrade over time, because they are usually mixed together with the alkalinity source. This equates to a limited shelf-life for compositions containing these bleaching materials, as well as a drop in cleaning performance over time.

It is therefore desired to maintain the stability of oxygen bleaches over time.

SUMMARY

5 The present invention relates to a method for providing a plurality of separate chambers to make and use an activated bleach mixture. The separate chambers include an aqueous component chamber which has from about 10% to about 90% moisture and an aqueous component, and a non-aqueous component chamber which has a non-aqueous solvent and a non-aqueous
10 component. The separate chambers maintain the contents of the aqueous component chamber and the non-aqueous component chamber in a substantially unmixed state. Also provided is an alkalinity source. An activated bleach mixture is made by commingling the contents of the aqueous component chamber, the non-aqueous component chamber, and the alkalinity source. This
15 forms an activated bleach mixture having an available peroxyacid oxygen level of at least about 200 ppm. The activated bleach mixture can then be used in a cleaning application.

 The current invention also provides for a kit for making and using an activated bleach mixture.

20 These and other features, aspects, and advantages of the present invention will become evident to those skilled in the art from a reading of the present disclosure with the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

25 While the specification concludes with claims particularly pointing out and distinctly claiming the invention, it is believed that the present invention will be better understood from the following description of preferred, nonlimiting embodiments and representations taken in conjunction with the accompanying drawings, in which like numerals identify identical elements and wherein:

30 Fig. 1 shows a dual chamber embodiment of the current invention.

 Fig. 2 shows a cross-sectional view of Fig. 1 as seen along line 1-1.

 Fig. 3 shows a triple chamber embodiment of the current invention.

 Fig. 4 shows a triple chamber embodiment of the current invention.

35 The above drawings are for reference purposes only, and not necessarily drawn to scale.

DETAILED DESCRIPTION

In accordance with the present invention it has been found that an oxygen bleaching system can possess surprising stability over time in a cleaning composition and have improved cleaning properties. The oxygen bleaching system herein physically separates at least one of the active oxygen source, the bleach activator, and the alkalinity source, until they are commingled to form an activated bleach mixture. The activated bleach mixture can then be used in a cleaning application.

All percentages, ratios and proportions herein are by weight, unless otherwise specified. All temperatures are in degrees Celsius (°C) unless otherwise specified. All documents cited are incorporated herein by reference.

The term "detergent enzyme", as used herein, indicates an enzyme having a cleaning, stain removing, or otherwise beneficial effect in cleaning compositions.

The term "low-polarity" as used herein when referring to non-aqueous solvents indicates those non-aqueous solvents which have little, if any, tendency to dissolve the preferred types of particulate materials which can be suspended in the compositions prepared herein, e.g., the active oxygen sources, sodium perborate or sodium percarbonate.

The term "moisture" as used herein includes both free and bound moisture, as well as free and bound water.

The term "non-aqueous" as used herein refers to compositions having less than about 5% moisture, preferably less than about 1% moisture by weight.

The term "ppm" as used herein is an acronym for "parts per million."

The bleaching system has at least two separate chambers, containing an active oxygen source, a bleach activator, moisture, and an alkalinity source. The separate chambers provide a means to maintain the contents thereof in a substantially unmixed state until the user is ready to activate and use the bleaching system. To use the bleaching system, the user commingles the contents of the separate chambers. This commingling combines the active oxygen source, the bleach activator, the alkalinity source, and moisture, which in turn forms the activated bleach mixture. The formed activated bleach mixture has an available peroxyacid oxygen level of at least 200 ppm.

The bleaching system of the invention is based upon three basic principles: (1) there must be at least one aqueous component chamber and at least one non-aqueous component chamber (hereinafter, "principle 1"); (2) there must be an active oxygen source, a bleach activator, and an alkalinity source (hereinafter, "principle 2"); and (3) the active oxygen source, the bleach activator, and the alkalinity source should not all be in the same separate chamber (hereinafter, "principle 3").

In the invention herein, the active oxygen source, bleach activator, and alkalinity source are separated by placing them in at least two separate chambers. Of these, at least one separate chamber is an aqueous component chamber which contains from about 10% to about 90% moisture and an aqueous component. At least one other separate chamber is a non-aqueous component chamber containing a non-aqueous solvent and a non-aqueous component. For example, in a two-chamber embodiment as shown in Fig. 1, the active oxygen source can be in one of the above chambers, and a bleach activator can be in the other chamber. Also provided is an alkalinity source, which, subject to principle 3, can be in either of the separate chambers, or both of the separate chambers. For example, in a preferred embodiment, the active oxygen source is part of the aqueous component and located within the aqueous component chamber, while the bleach activator and the alkalinity source are part of the non-aqueous component and located in the non-aqueous component chamber.

Without intending to be limited by theory, it is believed that when combined in a single composition, the alkalinity, moisture, bleach activator, and active oxygen source cause either the active oxygen source and/or the bleach activator to degrade. Thus, the separate chambers of the invention help to maintain oxygen bleaching system stability, because they maintain the alkalinity, bleach activator, and active oxygen source in a substantially unmixed state. By utilizing separate chambers and thereby maintaining at least one of the active oxygen source, the bleach activator, or the alkalinity source in a physically distinct location, stability is significantly improved. The contents of the separate chambers can have many physical forms such as, for example, liquids, gels, pastes, suspensions of particles in a liquid, suspensions of particles in a gel, emulsions, etc. Least preferred for use in the separate chambers are granular and solid forms.

To make the activated bleach mixture, the contents of the separate chambers are commingled. This commingled mixture then forms an activated bleach mixture having an available peroxyacid oxygen level of at least 200 ppm. The activated bleach mixture is then ready to be used in a cleaning application.

5 For example, the activated bleach mixture can then be used in a laundry application as either a pre-treater, and/or added to the wash cycle. It is preferred that the activated bleach mixture be removed from the separate chambers for use and that the separate chambers do not enter the wash cycle; in a preferred embodiment, the activated bleach mixture is poured from the separate chambers

10 into the wash cycle.

Separate Chambers

The invention herein requires a plurality of separate chambers, which serve to maintain the contents thereof in a substantially unmixed state.

15 Furthermore, each separate chamber can be either an aqueous component chamber, or a non-aqueous component chamber; however, as noted in principle 1, there must be at least one aqueous component chamber and at least one non-aqueous component chamber. Aqueous components and moisture are only found in aqueous component chambers. Non-aqueous components and non-

20 aqueous solvents are only found in non-aqueous component chambers. Accordingly, the total number of separate chambers is variable, but must be at least two, because of principle 1. As described below, the contents of each corresponding aqueous component and each specific non-aqueous component are also variable. However, the active oxygen source, the bleach activator, and

25 the alkalinity source should be divided among the aqueous component chamber(s) and the non-aqueous component chamber(s) according to principle 3, so as to provide maximum stability. It is preferred that the active oxygen source and the bleach activator be located in separate chambers.

For example, if there are only two separate chambers, as seen for

30 example in Fig. 1, then the aqueous component can contain either one or two of the following: the active oxygen source, the bleach activator, and the alkalinity source. Accordingly, the non-aqueous component, subject to principle 2 and principle 3, would contain at a minimum the other remaining compound, or remaining two compounds. Table 1 shows four preferred embodiments having

35 only two chambers, with the alkalinity source contained therein.

Table 1

	1	2	3	4
Aqueous Component Chamber	AOS	AOS, BA	BA	AS
Non-aqueous Component Chamber	BA, AS	AS	AOS, AS	AOS, BA

In Table 1, "AOS" indicates the active oxygen source, "BA" indicates the bleach activator, and "AS" indicates the alkalinity source. The alkalinity source should be in at least one of the separate chambers. Other non-listed embodiments are also included herein, such as, for example, when the aqueous component chamber contains an active oxygen source and bleach activator, and the non-aqueous component chamber contains an alkalinity source and a bleach activator. If a surfactant component is included, then it can be included in either the aqueous chamber, the non-aqueous chamber, or both. Embodiments of the invention which have only two chambers are referred to as "dual chamber" embodiments.

However, the possible working aqueous and non-aqueous component chamber permutations increase with the number of separate chambers and the number of components. For example, embodiments having three separate chambers are preferred herein, and are referred to as "triple chamber" embodiments. Table 2 shows six preferred, non-limiting triple chamber embodiments; in the Table 2 embodiments, each chamber holds either an active oxygen source, a bleach activator, or a surfactant component. Many other triple chamber embodiments not shown in Table 2 are also operable and included herein. However, for purposes of simplification, Table 2 assumes that the active oxygen source, the bleach activator, and the surfactant component are located in three separate chambers. Also for simplification, the presence of the alkalinity source is not specifically indicated; however, it will be recognized that because the bleach activator and the active oxygen source are already separated, the alkalinity source can be in any, multiple, or even all three of the separate chambers.

Table 2

	1	3	3	4	5	6
<u>Active Oxygen Source</u>	aqueous component chamber	aqueous component chamber	aqueous component chamber	non-aqueous component chamber	non-aqueous component chamber	non-aqueous component chamber
Bleach Activator	aqueous component chamber	non-aqueous component chamber	non-aqueous component chamber	aqueous component chamber	non-aqueous component chamber	aqueous component chamber
Surfactant Component	non-aqueous component chamber	aqueous component chamber	non-aqueous component chamber	non-aqueous component chamber	aqueous component chamber	aqueous component chamber

Thus, embodiment 1 in Table 2 has two aqueous component chambers (the first containing the active oxygen source, and the second containing the bleach activator), and one non-aqueous component chamber (containing the surfactant component). Non-limiting examples of triple chamber package embodiments are described in Fig. 3 and Fig. 4.

Further combinations of the invention are also included herein, for example, when four or more separate chambers are present. For example, in a preferred embodiment, the active oxygen source, the bleach activator, the alkalinity source, and the surfactant component are located in four separate chambers. Because each separate chamber can be either aqueous or non-aqueous (subject to principle 1), the possible permutations of these further embodiments increase exponentially. It is preferred that the bleaching system described herein have from about 2 to about 5 separate chambers.

The separate chambers can be positioned in many different arrangements. For example, they can be made as unattached chambers, or as a single package having attached chambers and an adjoining partition, as seen for example in Fig. 1. The separate chambers can also be constructed so as to be rigid, flexible, or both, as desired. Furthermore, depending upon the relative amounts and concentrations of the contents of thereof, the separate chambers can be made to contain the same volume, or different volumes. The bleaching system can be designed such that the activated bleach mixture can be made either outside of the separate chambers or within a package which is divided into separate chambers, such as described below.

Gas-generating ingredients, such as oxygen bleach precursors can be and are intended for use herein. Therefore, if the activated bleach mixture is to be made within the package, it is preferred that the separate chambers of the package be made or filled so as to take into account gas evolution therein. For example, this can be achieved by making the separate chambers large enough to contain the gas evolved, only partly filling the separate chambers, or otherwise providing a gas-venting mechanism. In a preferred embodiment, a single package is divided into separate chambers via an adjoining partition, and the activated bleach mixture is made in the single package. If gas is evolved therein, the separate chambers should be sealed such that the separate chambers do not prematurely rupture due to internal pressure.

The separate chambers can be made of many materials, so long as the separate chambers maintain the contents thereof in a substantially unmixed state. Preferred separate chamber materials are materials which are clear, flexible, and/or water and solvent-impervious. Examples of preferred separate chamber materials useful herein are plastics, coated papers, foils, membranes, nylon, and combinations thereof. More preferred separate chamber materials include laminated nylon, thin plastics, and combinations thereof. The separate chambers can be made of the same materials or of different materials, as desired.

The means to seal the separate chambers also varies according to the type of material, but preferred sealing means for flexible portions of the separate chambers are heat sealing, ultrasonic sealing, adhesives, and combinations thereof. Preferred sealing means for rigid portions of the separate chambers are threaded screws, adhesives, hinges, snap-type closures, and combinations thereof. In a preferred embodiment, the separate chambers are made of a flexible material, because they allow the contents of the separate chambers to be easily commingled when the seal is broken or removed. Flexible materials also allow the activated bleach mixture to be easily dispensed for use. In a preferred embodiment, the separate chambers are made from a flexible material and are heat sealed to form one or more outer seals. An embodiment of such a seal is seen for example, in Fig. 1 at 3. In a preferred embodiment the separate chambers have at least one spout and/or perforation to facilitate dispensing of the contents.

The separate chambers may also contain, in addition to the outer seal, breaking seals and non-breaking seals to further partition the package. The total number of seals present can vary according to the type of materials used for the separate chambers, the number of separate chambers, their alignment, etc. To allow easy commingling, one or more breaking seals can be used, especially between separate chambers which are made with a flexible material. Breaking seals are intended to prevent commingling but to give way, for example, upon the exertion of manual pressure, when the activated bleaching mixture is to be made and used. Breaking seals are therefore intended to be weaker than the outer seal. Breaking seals can be achieved in many ways, such as for example, using a laminate or film which has a strong adhesive on one side and a weak adhesive on the other, a seal which is much thinner than the outer seal, weakly heat-sealing the separate chamber, utilizing a different sealing method than in the outer seals and non-breaking seals, etc. In a preferred embodiment, a breaking seal, as seen, for example, in Fig. 1 at 4, is used as an adjoining partition between the separate chambers; thus the breaking seal provides a means for forming separate chambers which possess a relatively weak seal at one or more points therebetween. A non-breaking seal is shown, for example, in Fig. 4, at 20, and should be at least stronger than any breaking seals. In a preferred embodiment, any non-breaking seals are as strong as the outer seal(s). To prevent premature commingling and reduce messiness, all seals, including breaking seals, outer seals, or non-breaking seals, should be substantially solvent-tight and/or water-tight.

25 Aqueous Component Chamber

The separate chambers must have at least one aqueous component chamber containing from about 10% to about 90% moisture and an aqueous component. Moisture is the aqueous solvent, and the aqueous component can be dissolved in solution and/or suspended therein. The aqueous component chamber contains from about 10% to about 99%, preferably from about 50% to about 95%, and more preferably from about 70% to about 95% moisture, by weight. The aqueous component chamber also contains from about 1% to about 90%, preferably from about 5% to about 50%, and more preferably from about 5% to about 30% of an aqueous component, by weight. The aqueous component can be either one or two components selected from the active

oxygen source, the bleach activator, and the alkalinity source, subject to principle 3. The aqueous component can be dissolved and/or suspended in the aqueous solvent. In addition, the aqueous component chamber can also contain a surfactant component, and/or other deterative ingredients.

5 For dual chamber embodiments, as noted in Table 1, above, the aqueous component contains one or two of: the active oxygen source, the bleach activator, and the alkalinity source, while the remaining compound(s) is/are located in the non-aqueous component chamber, as described below.

10 For triple chamber embodiments, as described in Table 2, above, there may be either one or two aqueous component chambers, as principle 1 requires that at least one separate chamber be a non-aqueous component chamber. Accordingly, subject to principle 3, the aqueous component for any given chamber can contain one or more of the following: the active oxygen source, the bleach activator, the alkalinity source, and the surfactant component.

15 For other embodiments, such as when there are four or more chambers, the possible permutations of the invention increase dramatically, but the three basic principles remain constant; (1) there must be at least one aqueous component chamber and at least one non-aqueous component chamber; (2) there must be an active oxygen source, a bleach activator, and an alkalinity source; and (3) the active oxygen source, the bleach activator, and the alkalinity source should not all be in the same separate chamber.

Non-Aqueous Component Chamber

25 In addition to having at least one aqueous component chamber, the bleaching system of the current invention must also have at least one non-aqueous component chamber (principle 1). The non-aqueous component chamber contains a non-aqueous solvent and a non-aqueous component. The non-aqueous component can be dissolved and/or suspended in the non-aqueous solvent. Preferred non-aqueous solvents useful herein are those which are thermally stable, do not degrade the container, are easily dispersible in aqueous solution, and have less than about 5% free moisture, preferably less than about 1% free moisture, by weight of the solvent. The non-aqueous component chamber contains from about 45% to about 95%, preferably from about 50% to about 95%, and more preferably from about 50% to about 70%, by weight, of a non-aqueous solvent.

A preferred non-aqueous solvent useful herein is one having a low polarity, such as non-vicinal C₄-C₈ alkylene glycol, alkylene glycol mono lower alkyl ether, lower molecular weight polyethylene glycol, lower molecular weight methyl ester and amide, and the like, and mixtures thereof. A preferred type of non-aqueous, low-polarity solvent for use in the compositions prepared herein comprises non-vicinal C₄-C₈ branched or straight chain alkylene glycol. Materials of this type include hexylene glycol (4-methyl-2,4-pentanediol), 1,6-hexanediol, 1,3-butylene glycol and 1,4-butylene glycol. Hexylene glycol is very preferred.

Another preferred non-aqueous, low-polarity solvent for use herein comprises the mono-, di-, tri-, or tetra- C₂-C₃ alkylene glycol mono C₂-C₆ alkyl ethers. The specific examples of such compounds include diethylene glycol monobutyl ether, tetraethylene glycol monobutyl ether, dipropylene glycol monoethyl ether, and dipropylene glycol monobutyl ether. Diethylene glycol monobutyl ether, dipropylene glycol monobutyl ether and butoxy-propoxy-propanol (BPP), and mixtures thereof are especially preferred. Compounds of the type have been commercially marketed under the tradenames Dowanol, Carbitol, and Cellosolve.

Another preferred type of non-aqueous, low-polarity organic solvent useful herein comprises the lower molecular weight polyethylene glycols (PEGs). Such materials are those having an average molecular weight of at least about 150.

Yet another preferred non-aqueous solvent comprises the lower molecular weight methyl esters. Such materials are those of the general formula: R¹-C(O)-OCH₃ wherein R¹ ranges from 1 to about 18. Examples of suitable lower molecular weight methyl esters include methyl acetate, methyl propionate, methyl octanoate, methyl dodecanoate, and mixtures thereof.

The non-aqueous solvent employed should, of course, be compatible and non-reactive with other composition components, e.g., the active oxygen source and/or bleach activators, used herein.

A more preferred non-aqueous solvent includes glycerol, PEG having an average molecular weight of between about 150 and about 600, 1,3-butylene glycol, and mixtures thereof. In addition, the non-aqueous component can also contain a surfactant component, and/or other deterative ingredients.

The non-aqueous component chamber also contains from about 5% to about 55%, preferably from about 5% to about 50%, and more preferably from

about 30% to about 50% of a non-aqueous component. The exact composition of any specific non-aqueous component depends upon the aqueous component, the number of aqueous component chambers, and the number of non-aqueous component chambers.

5 As noted above, and according to principle 2 and principle 3, dual-chamber embodiments contain in the non-aqueous component the active oxygen source, the bleach activator, and/or the alkalinity source; whichever compound(s) is/are not contained in the aqueous component chamber.

10 Similarly, in triple chamber embodiments, such as those described in Table 2 and subject to the three principles above, there may be more than one non-aqueous component chamber, containing the same or different non-aqueous solvent(s), and non-aqueous component(s).

Commingling of Contents

15 The activated bleach mixture is made by commingling the contents the aqueous component chamber, the non-aqueous component chamber, and the alkalinity source. This can occur, for example, by moving a partition, by squeezing the contents of a separate chamber into another, by pouring the contents of one separate chamber into another, by breaking the barrier between
20 separate chambers, and/or otherwise causing the contents of the aqueous component chamber(s) and the non-aqueous component chamber(s) to combine. The commingling causes the bleach activator, the active oxygen source, and the alkalinity source to mix with moisture, to make the activated bleach mixture. The active oxygen source and the bleach activator will then
25 begin generating available peroxyacid oxygen.

Available Peroxyacid Oxygen

30 When the contents of the separate chambers are commingled, the active oxygen source and bleach activator begin to produce available peroxyacid oxygen in the activated bleach mixture. The available peroxyacid oxygen level in the activated bleach mixture is at least 200 ppm, preferably from about 200 ppm to about 2000 ppm, more preferably from about 400 ppm to about 1000 ppm. The available peroxyacid oxygen level is typically measurable by standard methods such as iodide/thiosulfate and/or ceric sulfate titration. See the well-
35 known work by Swern, or Kirk Othmer's Encyclopedia of Chemical Technology

under "Bleach Precursors." When the oxygen bleach is a peroxygen compound, it contains -O-O- linkages with one O in each such linkage being "active."

Most available oxygen measurement methods measure the total available oxygen. The total available oxygen is equal to the available peroxide oxygen plus the available peroxyacid oxygen. Therefore, to determine the available peroxyacid oxygen level, it is necessary to remove the available peroxide oxygen. This can be done, for example, by destroying the peroxide by adding catalase. In a preferred method for measuring the available peroxyacid oxygen level, an aliquot of the solution is removed, and the peroxide destroyed by adding catalase. The solution can then be reacted with iodide at about 80°C under argon, and further titrated with thiosulfate. The titration can be done in aqueous solution, or the solution can be extracted with propyl acetate. Iodine formation can be measured by measuring absorption at 420 nm, using a spectrometer, and the concentration calculated by multiplying by the dilution factor. Electrometric titration methods can also be used to determine the available peroxyacid titration level.

When the available peroxyacid oxygen level reaches at least about 200 ppm, the activated bleach mixture is ready and can be used in a cleaning application.

Active Oxygen Source

The active oxygen source useful herein includes compounds which form available peroxyacid oxygen when exposed to a bleach activator, an alkalinity source, and moisture. An active oxygen source can be hydrophilic, hydrophobic, or both. The active oxygen source useful in the present invention can be any of the oxidizing agents known for laundry, hard surface cleaning, automatic dishwashing, or denture cleaning purposes, including oxygen. A preferred active oxygen source of the peroxygen type includes hydrogen peroxide, inorganic percompounds, inorganic peroxohydrates, organic peroxohydrates, and mixtures thereof; a more preferred active oxygen source includes hydrogen peroxide, perborate, percarbonate, and mixtures thereof.

Also useful herein as an active oxygen source are the inorganic peroxides such as Na_2O_2 , superoxides such as KO_2 , organic hydroperoxides such as cumene hydroperoxide and t-butyl hydroperoxide, and the inorganic peroxyacids and their salts such as the peroxosulfuric acid salts, especially the potassium

salts of peroxodisulfuric acid and mixtures thereof; more preferably, of peroxomonosulfuric acid including the commercial triple-salt form sold as OXONE™ by DuPont and also any equivalent commercially available forms such as CUROX™ from Akzo or CAROAT™ from Degussa. Certain organic
5 peroxides, such as dibenzoyl peroxide, may be useful, especially as additives rather than as a primary active oxygen source. A preferred active oxygen source, as noted, includes peroxohydrates, sometimes known as peroxyhydrates or peroxohydrates. These are organic or, more commonly, inorganic salts capable of releasing hydrogen peroxide readily. They include types in which
10 hydrogen peroxide is present as a true crystal hydrate, and types in which hydrogen peroxide is incorporated covalently and is released chemically, for example by hydrolysis. Typically, peroxohydrates deliver hydrogen peroxide readily enough that it can be extracted in measurable amounts into the ether phase of an ether/water mixture. Peroxohydrates are characterized in that they
15 fail to give the Riesenfeld reaction, in contrast to certain other active oxygen sources. Peroxohydrates are the most common examples of "hydrogen peroxide source" materials and include the perborates, percarbonates, perphosphates, and persilicates.

Other materials which serve to produce or release hydrogen peroxide are,
20 of course, useful. Mixtures of two or more peroxohydrates can be used, for example when it is desired to exploit differential solubility. Suitable peroxohydrates include sodium carbonate peroxyhydrate and equivalent commercial "percarbonate" bleaches, and any of the so-called sodium perborate hydrates, the "tetrahydrate" and "monohydrate" being preferred; though sodium
25 pyrophosphate peroxyhydrate can be used. Many such peroxohydrates are available in processed forms with coatings, such as of silicate and/or borate and/or waxy materials and/or surfactants, or have particle geometries, such as compact spheres, which improve storage stability. By way of organic peroxohydrates, urea peroxyhydrate can also be useful herein. Percarbonate
30 bleach includes, for example, dry particles having an average particle size in the range from about 500 micrometers to about 1,000 micrometers, not more than about 10% by weight of said particles being smaller than about 200 micrometers and not more than about 10% by weight of said particles being larger than about 1,250 micrometers. These percarbonates are compatible with non-aqueous

solvents. Percarbonates and perborates are widely available in commerce, for example from FMC, Solvay and Tokai Denka.

Another suitable hydrogen peroxide generating system is a combination of a C₁-C₄ alkanol oxidase and a C₁-C₄ alkanol, especially a combination of methanol oxidase (MOX) and ethanol (the corresponding bleach activators). Such combinations are disclosed in WO 94/03003 to Labounty, et al., published February 3, 1994. Other enzymatic materials related to bleaching, such as peroxidases, haloperoxidases, oxidases, superoxide dismutases, catalases and their enhancers or, more commonly, inhibitors, may be used as optional ingredients in the instant compositions.

If an active oxygen source is present in a non-aqueous component chamber, then a preferred active oxygen source includes perborate, percarbonate, and mixtures thereof. If an active oxygen source is present in a aqueous component chamber, then a preferred active oxygen source is hydrogen peroxide.

The active oxygen source herein can have any physical form compatible with the intended application; more particularly, liquid-forms and solid-forms. Liquids can be included in solid detergents, for example by adsorption onto an inert support; and solids can be included in liquid detergents, for example by use of compatible suspending agents. An active oxygen source will typically be at a level of from about 1% to about 30%, more typically from about 5% to about 20%, of the cleaning composition, especially for fabric laundering.

Bleach Activator

When combined with the alkalinity source and moisture, the bleach activator leads to production of the percarboxylic acid corresponding to the bleach activator, which in turn reacts with the active oxygen source to produce available peroxyacid oxygen. A bleach activator useful herein includes amides, imides, esters, anhydrides, and mixtures thereof. Usually, at least one substituted or unsubstituted acyl moiety is present, covalently connected to a leaving group as in the structure R-C(O)-L. The atom in the leaving group connecting to the peracid-forming acyl moiety R(C)O- is most typically O or N. A bleach activator can have non-charged, positively or negatively charged peracid-forming moieties and/or noncharged, positively or negatively charged leaving groups. One or more peracid-forming moieties or leaving-groups can be present.

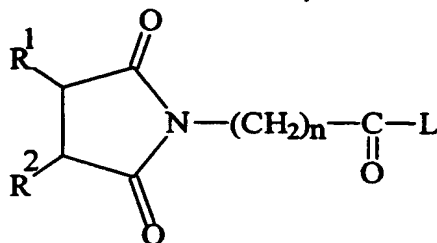
See, for example, U.S. 5,595,967 to Kellett, et al., issued January 21, 1997, U.S. 5,561,235 to Burns, et al., issued October 1, 1996, U.S. 5,560,862 to Burns, et al., issued October 1, 1996 or the bis-(peroxy-carbonic) system of U.S. 5,534,179 to Kellett, et al., issued July 9, 1996. A bleach activator can be substituted with
5 electron-donating or electron-releasing moieties either in the leaving-group or in the peracid-forming moiety or moieties, changing their reactivity and making them more or less suited to particular pH or wash conditions. For example, electron-withdrawing groups such as NO₂ improve the efficacy of bleach
10 activators intended for use in mild-pH (e.g., from about 7.5 to about 9.5) wash conditions. The bleach activator can have many physical forms, for example, the bleach activator itself can be hydrous, or an anhydrous solid or liquid in a non-aqueous solvent.

Examples of a cationic bleach activator includes quaternary carbamate-, quaternary carbonate-, quaternary ester-, quaternary amide-, and mixtures
15 thereof, delivering a range of cationic peroxyimidic, peroxy-carbonic or peroxy-carboxylic acids to the wash. An analogous but non-cationic palette of bleach activators is available when quaternary derivatives are not desired. In more detail, examples of a cationic bleach activator includes the quaternary ammonium-substituted bleach activators of WO 96-06915 to Baillely, et al.,
20 published March 7, 1996, U.S. 4,751,015 to Humphreys, et al., issued June 14, 1988 and 4,397,757 to Bright and Postlethwaite, issued August 9, 1983, EP-B-284292 to Aoyagi, et al., issued October 19, 1994, EP-B-331,229 to Darwent, et al., issued August 18, 1993 and including 2-(N,N,N-trimethyl ammonium) ethyl-4-sulphophenyl carbonate-(SPCC); N-octyl,N,N-dimethyl-N 10-carbophenoxy decyl
25 ammonium chloride-(ODC); 3-(N,N,N-trimethyl ammonium) propyl sodium-4-sulphophenyl carboxylate; and N,N,N-trimethyl ammonium toluoyloxy benzene sulfonate. Also useful are cationic nitriles as disclosed in EP-B1-303,520 to Aoyagi, et al., issued April 20, 1994 and in European Patent Specification 458,396 to Oakes, et al., published November 27, 1991 and 464,880 to Adams,
30 et al., issued December 14, 1994. Other nitrile types such as 3,5-dimethoxybenzonitrile and 3,5-dinitrobenzonitrile can also be used.

Other bleach activator disclosures include GB 836,988 to Davies, et al., published June 9, 1960; GB 864,798 to Hampson and McDonnell, published April 6, 1961; GB 907,356 to Maddox, et al., published October 3, 1962; GB
35 1,003,310 to Chase and Samuels, published September 2, 1965 and GB

1,519,351 to Wellwood, published July 26, 1978; German Patent 3,337,921 to Balzer, et al., published May 2, 1985; EP-B-0185522 to Fong and Kong, issued November 7, 1990; EP-B-0174132 to Divo, issued December 14, 1988; U.S. Pat. No. 1,246,339 to Smit, issued November 13, 1917; U.S. 3,332,882 to
 5 Blumbergs, et al., issued July 25, 1967; U.S. 4,128,494 to Schirmann, et al., issued December 5, 1978; U.S. 4,412,934 to Chung and Spadini, issued November 1, 1983 and U.S. 4,675,393 to Coxon, issued June 23, 1987, and the phenol sulfonate ester of alkanoyl aminoacids disclosed in U.S. 5,523,434 to Burns and Simpson, issued June 4, 1996. Suitable bleach activators include any
 10 acetylated diamine types, whether hydrophilic or hydrophobic in character.

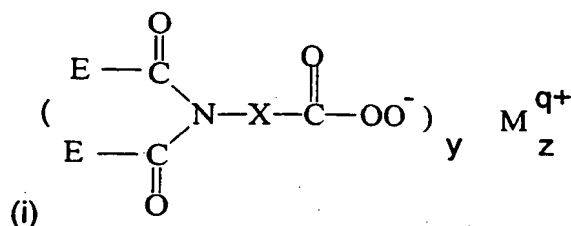
A preferred class of bleach activator includes the esters, including acyl phenol sulfonates, acyl alkyl phenol sulfonates or acyl oxybenzenesulfonates (OBS leaving-group); the acyl-amides; the quaternary ammonium substituted peroxyacid precursors including the cationic nitriles, and mixtures thereof. A
 15 preferred hydrophobic bleach activator includes sodium nonanoyloxybenzene sulfonate (NOBS or SNOBS), substituted amide types described in detail hereinafter, and the bleach activators related to certain imidoperacid bleaches, for example as described in U.S. Patent 5,061,807 to Gethoffer, et al., issued October 29, 1991 and assigned to Hoechst Aktiengesellschaft of Frankfurt,
 20 Germany. Japanese Laid-Open Patent Application (Kokai) No. 4-28799 to Yamada, et al., published January 31, 1992 for example describes a bleaching agent and a bleaching cleaning composition comprising an organic peracid precursor described by a general formula and illustrated by compounds which may be summarized more particularly as conforming to the formula:



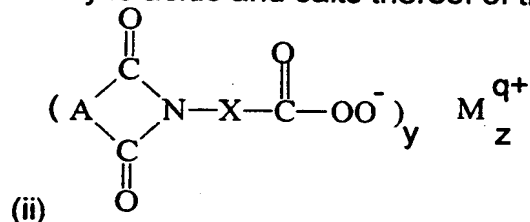
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wherein L is sodium *p*-phenolsulfonate, R¹ is CH₃ or C₁₂H₂₅ and R² is H. Analogs of these compounds having any of the leaving-groups identified herein and/or having R¹ being linear or branched C₆-C₁₆ are also useful.

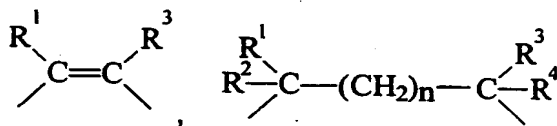
Another bleach activator herein are those derivable from acyclic
 30 imidoperoxydicarboxylic acids and salts thereof of the formula:



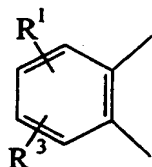
cyclic imidoperoxycarboxylic acids and salts thereof of the formula:



and (iii) mixtures of said compounds, (i) and (ii); wherein M is selected from hydrogen and bleach-compatible cations having charge q; and y and z are integers such that said compound is electrically neutral; E, A and X comprise hydrocarbyl groups; and said terminal hydrocarbyl groups are contained within E and A. The structure of the corresponding bleach activator is obtained by deleting the peroxy moiety and the metal and replacing it with a leaving-group L, which can be any of the leaving-group moieties defined elsewhere herein. In preferred embodiments, in any of said compounds, X is a linear C₃-C₈ alkyl; A is selected from:



wherein n is from 0 to about 4, and



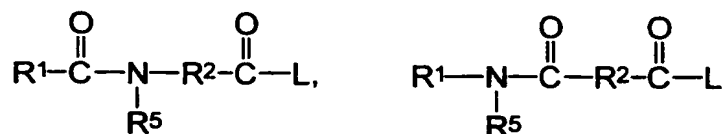
wherein R¹ and E are said terminal hydrocarbyl groups, R², R³ and R⁴ are independently selected from H, C₁-C₃ saturated alkyl, and C₁-C₃ unsaturated alkyl; and wherein said terminal hydrocarbyl groups are alkyl groups comprising at least six carbon atoms, more typically linear or branched alkyl having from about 8 to about 16 carbon atoms.

Another suitable bleach activator includes sodium-4-benzoyloxy benzene sulfonate (SBOBS); sodium-1-methyl-2-benzoyloxy benzene-4-sulphonate;

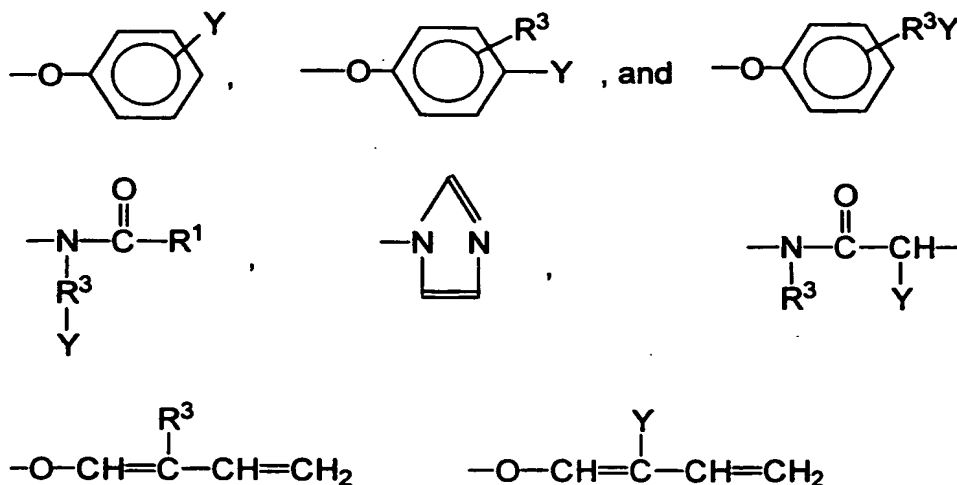
sodium-4-methyl-3-benzoyloxy benzoate; trimethyl ammonium toluoyloxybenzene sulfonate; sodium 3,5,5-trimethyl hexanoyloxybenzene sulfonate (STHOBS), and mixtures thereof.

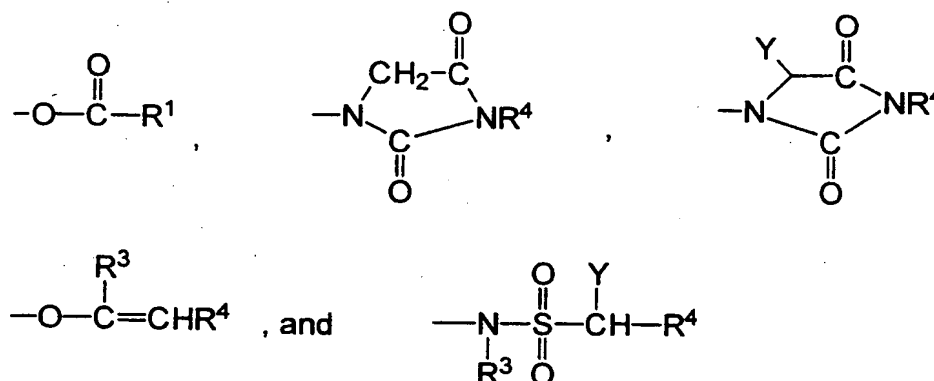
A preferred bleach activator includes N,N,N',N'-tetraacetyl ethylene diamine (TAED) or any of its close relatives including the triacetyl or other unsymmetrical derivatives, and mixtures thereof. TAED and the acetylated carbohydrates such as glucose pentaacetate and tetraacetyl xylose are preferred. Depending on the application, acetyl triethyl citrate, a liquid, also has some utility, as does phenyl benzoate.

A highly preferred bleach activator useful herein is amide-substituted and has either of the formulae:



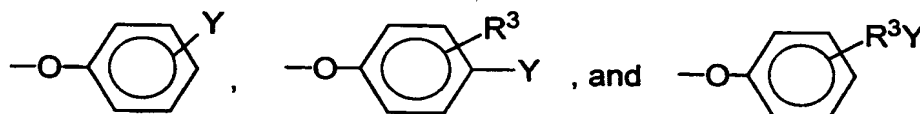
or mixtures thereof, wherein R^1 is alkyl, aryl, or alkaryl containing from about 1 to about 14 carbon atoms including both hydrophilic types (short R^1) and hydrophobic types (especially when R^1 is from about 8 to about 12), R^2 is alkylene, arylene or alkarylene containing from about 1 to about 14 carbon atoms, R^5 is H, or an alkyl, aryl, or alkaryl containing from about 1 to about 10 carbon atoms, and L is a leaving group. A preferred bleach activator includes those of the formulae, hereinabove, for example the amide-substituted formulae, wherein R^1 , R^2 and R^5 are as defined for the corresponding peroxyacid and L is selected from the group consisting of:





and mixtures thereof, wherein R^1 is a linear or branched alkyl, aryl, or alkaryl group containing from about 1 to about 14 carbon atoms, R^3 is an alkyl chain containing from 1 to about 8 carbon atoms, R^4 is H or R^3 , and Y is H or a solubilizing group. These and other known leaving groups are, more generally, suitable alternatives for introduction into any bleach activator herein. Preferred solubilizing groups include $\text{---SO}_3^-\text{M}^+$, $\text{---CO}_2^-\text{M}^+$, $\text{---SO}_4^-\text{M}^+$, $\text{---N}^+(\text{R})_4\text{X}^-$ and $\text{O} \leftarrow \text{N}(\text{R}^3)_2$, more preferably $\text{---SO}_3^-\text{M}^+$ and $\text{---CO}_2^-\text{M}^+$ wherein R^3 is an alkyl chain containing from about 1 to about 4 carbon atoms, M is a bleach-stable cation and X is a bleach-stable anion, each of which is selected consistent with maintaining solubility of the bleach activator.

A preferred bleach activator also includes those of the above general formula wherein L is selected from the group consisting of:

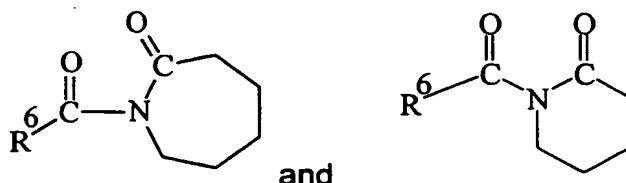


wherein R^3 is as defined above and Y is $\text{---SO}_3^-\text{M}^+$ or $\text{---CO}_2^-\text{M}^+$ wherein M is as defined above.

Preferred examples of a bleach activator of the above formulae include (6-octanamidocaproyl) oxybenzenesulfonate, (6-nonanamidocaproyl) oxybenzenesulfonate, (6-decanamidocaproyl) oxybenzenesulfonate, and mixtures thereof. Nonlimiting examples of an additional bleach activator useful herein are to be found in U.S. 4,915,854 to Baker, et al., issued April 10, 1990, U.S. 4,412,934 to Chung and Spadini, issued November 1, 1983 and U.S. 4,634,551 to Hardy and Ingram, issued January 6, 1987. The hydrophobic activator NOBS and the hydrophilic TAED activator are typical, and mixtures

thereof can also be used. A preferred bleach activator includes para-acetoxybenzene sulphonate, triacetyl cyanurate, and tetra acetyl glycol uril.

The acyl lactam bleach activators are also very useful herein, especially the acyl caprolactams (see for example WO 94-28102 A to Burns, et al.,
5 published December 8, 1994) and acyl valerolactams (see) of the formulae:



wherein R^6 is H, alkyl, aryl, alkoxyaryl, an alkaryl group containing from 1 to about 12 carbon atoms, or substituted phenyl containing from about 6 to about 18 carbons. Also useful are acyl caprolactams, including benzoyl caprolactam
10 adsorbed into sodium perborate. In certain preferred embodiments of the invention, a NOBS, lactam bleach activator, imide bleach activator, or amide-functional bleach activator, especially the more hydrophobic derivatives, are desirably combined with a hydrophilic bleach activator such as TAED, typically at weight ratios of hydrophobic bleach activator : TAED in the range of 1:5 to 5:1,
15 preferably about 1:1. Other suitable examples of a lactam bleach activator are alpha-modified, see WO 96-22350 A1 to Burekett, et al., published July 25, 1996. A lactam bleach activator, especially the more hydrophobic types, are desirably used in combination with TAED, typically at weight ratios of amido-derived or caprolactam bleach activator : TAED in the range of 1:5 to 5:1,
20 preferably about 1:1. See also the bleach activator having a cyclic amidine leaving-group disclosed in U.S. 5,552,556 to Burns, et al., issued September 3, 1996.

An additional bleach activator useful herein include those of U.S. 5,545,349 to Itoh, et al., issued August 13, 1996. Examples include esters of an
25 organic acid and ethylene glycol, diethylene glycol or glycerin, or the acid imide of an organic acid and ethylenediamine; wherein the organic acid is selected from methoxyacetic acid, 2-methoxypropionic acid, p-methoxybenzoic acid, ethoxyacetic acid, 2-ethoxypropionic acid, p-ethoxybenzoic acid, propoxyacetic acid, 2-propoxypropionic acid, p-propoxybenzoic acid, butoxyacetic acid, 2-butoxypropionic acid, p-butoxybenzoic acid, 2-methoxyethoxyacetic acid, 2-methoxy-1-methylethoxyacetic acid, 2-methoxy-2-methylethoxyacetic acid, 2-ethoxyethoxyacetic acid, 2-(2-ethoxyethoxy)propionic acid, p-(2-

ethoxyethoxy)benzoic acid, 2-ethoxy-1-methylethoxyacetic acid, 2-ethoxy-2-methylethoxyacetic acid, 2-propoxyethoxyacetic acid, 2-propoxy-1-methylethoxyacetic acid, 2-propoxy-2-methylethoxyacetic acid, 2-butoxyethoxyacetic acid, 2-butoxy-1-methylethoxyacetic acid, 2-butoxy-2-methylethoxyacetic acid, 2-(2-methoxyethoxy)ethoxyacetic acid, 2-(2-methoxy-1-methylethoxy)ethoxyacetic acid, 2-(2-methoxy-2-methylethoxy)ethoxyacetic acid and 2-(2-ethoxyethoxy)ethoxyacetic acid.

The bleach activator may be used in an amount of up to about 20%, preferably from about 0.1% to about 10% by weight, of the activated bleach mixture, though higher levels, such as 40% or more, are acceptable in highly concentrated bleaching systems.

Alkalinity Source

The method for making and using the activated bleach mixture of the current invention includes the step of providing an alkalinity source. The bleach activator requires an alkalinity source to rapidly activate the active oxygen source and rapidly evolve available peroxyacid oxygen. As described above, the alkalinity source should be in one or more of the separate chambers. An alkalinity source useful herein is one which maintains the commingled contents of the aqueous component chamber, if it is present therein, at a pH of from about 7 to about 14, preferably from about 9 to about 12. A preferred alkalinity source maintains the pH of the activated bleach mixture at from about 7 to about 14, preferably from about 9 to about 12. A preferred alkalinity source useful herein includes sodium and potassium hydroxide, carbonate, and mixtures thereof. Generally, the higher the pH of the commingled contents of the separate chambers, the faster the evolution of available peroxyacid oxygen.

Surfactant Component

An optional feature of the invention described herein is the providing of a surfactant component to improve cleaning efficacy, and the making of an activated bleach mixture by commingling the contents of the aqueous component chamber, the non-aqueous component chamber, the alkalinity source, and the surfactant component. The surfactant component can be included with the aqueous component and/or with the non-aqueous component. Alternatively, in embodiments having more than two separate chambers, the surfactant

component can be contained within a separate surfactant component chamber which is distinct from both the active oxygen source and the bleach activator.

The surfactant component can contain any surfactants useful in cleaning applications. A preferred surfactant component is selected from amphoteric surfactants, anionic surfactants, cationic surfactants, nonionic surfactants, zwitterionic surfactants, and mixtures thereof. Nonlimiting examples of a surfactant component particularly useful in the cleaning composition includes, the conventional C₁₁-C₁₈ alkyl benzene sulfonates ("LAS") and primary, branched-chain and random C₁₀-C₂₀ alkyl sulfates ("AS"), the C₁₀-C₁₈ secondary (2,3) alkyl sulfates of the formula $\text{CH}_3(\text{CH}_2)_x(\text{CHOSO}_3^-\text{M}^+)\text{CH}_3$ and $\text{CH}_3(\text{CH}_2)_y(\text{CHOSO}_3^-\text{M}^+)\text{CH}_2\text{CH}_3$ where x and $(y + 1)$ are integers of at least about 7, preferably at least about 9, and M is a water-solubilizing cation, especially sodium, unsaturated sulfates such as oleyl sulfate, the C₁₀-C₁₈ alkyl alkoxy sulfates ("AE_xS"; especially EO 1-7 ethoxy sulfates), C₁₀-C₁₈ alkyl alkoxy carboxylates (especially the EO 1-5 ethoxycarboxylates), the C₁₀-C₁₈ glycerol ethers, the C₁₀-C₁₈ alkyl polyglycosides and their corresponding sulfated polyglycosides, the C₁₂-C₁₈ alpha-sulfonated fatty acid esters, and mixtures thereof. If desired, the conventional nonionic and amphoteric surfactants such as the C₁₂-C₁₈ alkyl ethoxylates ("AE") including the so-called narrow peaked alkyl ethoxylates and C₆-C₁₂ alkyl phenol alkoxyates (especially ethoxylates and mixed ethoxy/propoxy), C₁₂-C₁₈ betaines and sulfobetaines ("sultaines"), C₁₀-C₁₈ amine oxides, and the like, can also be included in the overall compositions. The C₁₀-C₁₈ N-alkyl polyhydroxy fatty acid amides can also be used. Typical examples include the C₁₂-C₁₈ N-methylglucamides. See WO 92/06154 to Cook, et al., published April 16, 1992. Other examples of a sugar-derived surfactant component includes the N-alkoxy polyhydroxy fatty acid amides, such as C₁₀-C₁₈ N-(3-methoxypropyl) glucamide. The N-propyl through N-hexyl C₁₂-C₁₈ glucamides can be used for low sudsing. C₁₀-C₂₀ conventional soaps may also be used. If high sudsing is desired, the branched-chain C₁₀-C₁₆ soaps may be used. Mixtures of anionic and nonionic surfactants are especially useful. Other conventional useful surfactants are listed in standard texts. If present, the cleaning composition preferably comprises at least about 1%; more preferably at least about 10%; more preferably at least about 20%; more preferably still, from about 20% to about 60% of a surfactant component, by weight of the activated bleach mixture.

Surfactant Component Chamber

An optional feature of the bleaching system described herein is a surfactant component chamber. While not required, it is preferred that when
5 more than two separate chambers are present, the surfactant component is located in a surfactant component chamber. This chamber is a separate chamber which preferably contains a solvent and a surfactant component. Subject to principle 1 denoted above, the solvent can be either aqueous or non-aqueous. In a preferred embodiment, the surfactant component chamber
10 comprises moisture as a solvent. Subject to principle 3, the surfactant component chamber can further contain a bleach activator, an active oxygen source, and/or an alkalinity source. Furthermore, the surfactant component chamber can contain other deterative ingredients.

The contents of the surfactant component chamber can be commingled
15 with the contents of the other separate chambers to produce the activated bleach mixture. Alternatively, the contents of the surfactant component chamber can be used separately in a cleaning application, such as, for example, when the activated bleach mixture is used as a pre-treater, while the contents of the surfactant component chamber are used in the regular wash cycle. It is preferred
20 that the contents of the surfactant component chamber be commingled with the contents of the other separate chambers so as to form the activated bleach mixture.

Optional Deterative Ingredients

25 The following illustrates various other optional deterative ingredients which may be used herein, but is not intended to be limiting thereof.

Viscosity Controller

A viscosity controller such as a polymer, or mixtures of polymers can be optionally included in the contents of the separate chambers described herein.
30 They can serve to increase or decrease the viscosity of the contents of any separate chamber. It is preferred that a viscosity controller be used in non-aqueous component chambers to adjust the viscosity of the contents thereof. In addition to their use as non-aqueous solvents, polyethylene glycols (PEGs) can also be used as viscosity controllers. Preferred PEGs have an average

molecular weight of from about 100 to 1500, more preferably from about 200 to about 600.

Builders

A detergent builder can optionally be included in the compositions herein, for example to assist in controlling mineral, especially Ca and/or Mg, hardness in wash water or to assist in the removal of particulate soils from surfaces. The builder can operate via a variety of mechanisms including forming soluble or insoluble complexes with hardness ions, by ion exchange, and by offering a surface more favorable to the precipitation of hardness ions than the surfaces of articles to be cleaned. Builder level can vary widely depending upon end use and physical form of the composition. Built detergents typically comprise at least 1% builder. Liquid cleaning compositions typically comprise 5% to 50%, more typically 5% to 35% builder by weight. Lower or higher levels of builders are not excluded.

A suitable builder herein can be selected from the group consisting of phosphates and polyphosphates, especially the sodium salts; silicates including water-soluble and hydrous solid types and including those having chain-, layer-, or three-dimensional- structure as well as amorphous-solid or non-structured-liquid types; carbonates, bicarbonates, sesquicarbonates and carbonate minerals other than sodium carbonate or sesquicarbonate; aluminosilicates; organic mono-, di-, tri-, and tetracarboxylates especially water-soluble nonsurfactant carboxylates in acid, sodium, potassium or alkanolammonium salt form, as well as oligomeric or water-soluble low molecular weight polymer carboxylates including aliphatic and aromatic types; and phytic acid. These may be complemented by borates, e.g., for pH-buffering purposes, or by sulfates, especially sodium sulfate and any other fillers or carriers which may be important to the engineering of stable surfactant and/or builder-containing cleaning compositions.

Builder mixtures, sometimes termed "builder systems" can be used and typically comprise two or more conventional builders, optionally complemented by chelants, alkalinity sources or fillers, though these latter materials are generally accounted for separately when describing quantities of materials herein.

Suitable silicate builders include alkali metal silicates, particularly those liquids and solids having a $\text{SiO}_2\text{:Na}_2\text{O}$ ratio in the range 1.6:1 to 3.2:1, including,

particularly for automatic dishwashing purposes, solid hydrous 2-ratio silicates marketed by PQ Corp. under the tradename BRITESIL®, e.g., BRITESIL H2O; and layered silicates, e.g., those described in U.S. 4,664,839, May 12, 1987, H. P. Rieck. NaSKS-6, sometimes abbreviated "SKS-6", is a crystalline layered
5 aluminium-free δ -Na₂SiO₅ morphology silicate marketed by Hoechst. See preparative methods in German DE-A-3,417,649 and DE-A-3,742,043. Other silicates may also be useful, such as magnesium silicate, which can serve as a crispening agent in granules, as a stabilising agent for bleaches, and as a component of suds control systems.

10 Also suitable for use herein are synthesized crystalline ion exchange materials or hydrates thereof, as taught in U.S. 5,427,711, Sakaguchi et al, June 27, 1995. Suitable carbonate builders include alkaline earth and alkali metal carbonates as disclosed in German Patent Application No. 2,321,001 published on November 15, 1973, although sodium bicarbonate, sodium carbonate,
15 sodium sesquicarbonate, and other carbonate minerals may be useful.

Aluminosilicate builders can also be incorporated in liquids, pastes or gels. Suitable for the present purposes are those having empirical formula: $[M_z(AlO_2)_z(SiO_2)_v] \cdot xH_2O$ wherein z and v are integers of at least 6, the molar ratio of z to v is in the range from 1.0 to 0.5, and x is an integer from 15 to 264.

20 Aluminosilicates can be crystalline or amorphous, naturally-occurring or synthetically derived. Preferred synthetic crystalline aluminosilicate ion exchange materials are available as Zeolite A, Zeolite P (B), Zeolite X and, to whatever extent this differs from Zeolite P, the so-called Zeolite MAP. Natural types, including clinoptilolite, may be used. Zeolite A has the formula:
25 $Na_{12}[(AlO_2)_{12}(SiO_2)_{12}] \cdot xH_2O$ wherein x is from 20 to 30, especially 27. Dehydrated zeolites (x = 0 - 10) may also be used. Preferably, the aluminosilicate has a particle size of 0.1-10 microns in diameter.

Suitable organic detergent builders include ether polycarboxylates, polycarboxylate, including water-soluble nonsurfactant dicarboxylate and
30 tricarboxylate compounds. More typically builder polycarboxylates have a plurality of carboxylate groups, preferably at least 3 carboxylates.

Other suitable builders are the ether hydroxypolycarboxylates, copolymers of maleic anhydride with ethylene or vinyl methyl ether; 1, 3, 5-trihydroxy benzene-2, 4, 6-trisulphonic acid; carboxymethyloxysuccinic acid; the various
35 alkali metal, ammonium and substituted ammonium salts of polyacetic acids

such as ethylenediamine tetraacetic acid and nitrilotriacetic acid; as well as mellitic acid, succinic acid, polymaleic acid, benzene 1,3,5-tricarboxylic acid, carboxymethyloxysuccinic acid, and soluble salts thereof.

5 Citrates, e.g., citric acid and soluble salts thereof are important carboxylate builders e.g., for heavy duty liquid detergents, due to their availability from renewable resources and biodegradability.

Where permitted, alkali metal phosphates such as sodium tripolyphosphates, sodium pyrophosphate and sodium orthophosphate can be used. Phosphonate builders such as ethane-1-hydroxy-1,1-diphosphonate and
10 other known phosphonates, e.g., those of U.S. 3,159,581; U.S. 3,213,030; U.S. 3,422,021; U.S. 3,400,148 and U.S. 3,422,137 can also be used and may have desirable antiscaling properties. Also useful herein are succinic acid builders, fatty acid builders, mineral builders, and polycarboxylate builders such as those disclosed in U.S. 4,144,226, Crutchfield et al, March 13, 1979 and in U.S.
15 3,308,067, Diehl, March 7, 1967. See also Diehl, U.S. 3,723,322.

Enzymes

Enzymes can be included in the present cleaning compositions for a variety of purposes, including removal of protein-based, carbohydrate-based, or triglyceride-based stains from substrates, for the prevention of refugee dye
20 transfer in fabric laundering, and for fabric restoration. Suitable enzymes include amylases, cellulases, cutinases, lipases, peroxidases, proteases, and mixtures thereof of any suitable origin, such as vegetable, animal, bacterial, fungal and yeast origin. Preferred selections are influenced by factors such as pH-activity and/or stability optima, thermostability, and stability to active detergents,
25 builders. In this respect bacterial or fungal enzymes are preferred, such as bacterial amylases and proteases, and fungal cellulases. Preferred enzymes for laundry purposes include, but are not limited to, cellulases, lipases, peroxidases, and proteases. Highly preferred for automatic dishwashing are amylases and/or proteases.

30 Enzymes are normally incorporated into cleaning compositions at levels sufficient to provide a "cleaning-effective amount." The term "cleaning effective amount" refers to any amount capable of producing a cleaning, stain removal, soil removal, whitening, deodorizing, or freshness improving effect on substrates such as fabrics, dishware. In practical terms for current commercial
35 preparations, typical amounts are up to 5 mg more typically 0.01 mg to 3 mg, of

active enzyme per gram of the cleaning composition. Stated otherwise, the compositions herein will typically comprise from 0.001% to 5%, preferably 0.01%-1% by weight of a commercial enzyme preparation. Protease enzymes are usually present in such commercial preparations at levels sufficient to provide from 0.005 to 0.1 Anson units (AU) of activity per gram of composition. For certain detergents, such as in automatic dishwashing, it may be desirable to increase the active enzyme content of the commercial preparation in order to minimize the total amount of non-catalytically active materials and thereby improve spotting/filming or other end-results. Higher active levels may also be desirable in highly concentrated cleaning compositions.

Suitable examples of proteases are the subtilisins which are obtained from particular strains of *B. subtilis* and *B. licheniformis*. One suitable protease is obtained from a strain of *Bacillus*, having maximum activity throughout the pH range of 8-12, developed and sold as ESPERASE® by Novo Industries A/S of Denmark, hereinafter "Novo". The preparation of this enzyme and analogous enzymes is described in GB 1,243,784 to Novo. Other suitable proteases include ALCALASE® and SAVINASE® from Novo and MAXATASE® from International Bio-Synthetics, Inc., The Netherlands; as well as Protease A as disclosed in EP 130,756 A, January 9, 1985 and Protease B as disclosed in EP 303,761 A, April 28, 1987 and EP 130,756 A, January 9, 1985. See also a high pH protease from *Bacillus* sp. NCIMB 40338 described in WO 9318140 A to Novo. Enzymatic compositions comprising protease, one or more other enzymes, and a reversible protease inhibitor are described in WO 9203529 A to Novo. Other preferred proteases include those of WO 9510591 A to Procter & Gamble. When desired, a protease having decreased adsorption and increased hydrolysis is available as described in WO 9507791 to Procter & Gamble. A recombinant trypsin-like protease for compositions suitable herein is described in WO 9425583 to Novo. An especially preferred protease, referred to as "Protease D" as described in the patent applications of A. Baeck, et al, entitled "Protease-Containing Cleaning Compositions" having US Serial No. 08/322,676, and C. Ghosh, et al, "Bleaching Compositions Comprising Protease Enzymes" having US Serial No. 08/322,677, both filed October 13, 1994.

Amylases suitable herein, especially for, but not limited to automatic dishwashing purposes, include, for example, α -amylases described in GB 1,296,839 to Novo; RAPIDASE®, International Bio-Synthetics, Inc. and

TERMAMYL®, Novo. FUNGAMYL® from Novo is especially useful. Stability-enhanced amylases can be obtained from Novo or from Genencor International. Oxidative stability-enhanced amylases are preferred for use herein. Such preferred amylases include (a) an amylase according to the hereinbefore
5 incorporated WO 9402597, Novo, Feb. 3, 1994; (b) stability-enhanced amylases as described by Genencor International in a paper entitled "Oxidatively Resistant alpha-Amylases" presented at the 207th American Chemical Society National Meeting, March 13-17 1994, by C. Mitchinson; and (c) amylase variants having additional modification in the immediate parent as described in WO 9510603 A
10 and available from the assignee, Novo, as DURAMYL®. Other particularly preferred oxidative stability-enhanced amylases include those described in WO 9418314 to Genencor International and WO 9402597 to Novo. Any other oxidative stability-enhanced amylases can also be used, for example as derived by site-directed mutagenesis from known chimeric, hybrid or simple mutant
15 parent forms of available amylases. See also WO 9509909 A to Novo.

Cellulases usable herein include both bacterial and fungal types, preferably having a pH optimum between 5 and 9.5. U.S. 4,435,307, Barbesgoard et al, March 6, 1984, discloses suitable fungal cellulases from *Humicola insolens* or *Humicola* strain DSM1800 or a cellulase 212-producing
20 fungus belonging to the genus *Aeromonas*, and cellulase extracted from the hepatopancreas of a marine mollusk, *Dolabella Auricula Solander*. Suitable cellulases are also disclosed in GB-A-2.075.028; GB-A-2.095.275 and DE-OS-2.247.832. CAREZYME® and CELLUZYME® (Novo) are especially useful. See also WO 9117243 to Novo.

25 Cutinase enzymes suitable for use herein are described in WO 8809367 A to Genencor.

Suitable lipase enzymes include those produced by microorganisms of the *Pseudomonas* group, such as *Pseudomonas stutzeri* ATCC 19.154, as disclosed in GB 1,372,034. See also lipases in Japanese Patent Application 53,20487,
30 laid open Feb. 24, 1978. This lipase is available from Amano Pharmaceutical Co. Ltd., Nagoya, Japan, under the trade name Lipase P "Amano," or "Amano-P." Other suitable commercial lipases include Amano-CES, lipases ex *Chromobacter viscosum*, e.g. *Chromobacter viscosum* var. *lipolyticum* NRRLB 3673 from Toyo Jozo Co., Tagata, Japan; *Chromobacter viscosum* lipases from
35 U.S. Biochemical Corp., U.S.A. and Disoynth Co., The Netherlands, and lipases

ex *Pseudomonas gladioli*. LIPOLASE® enzyme derived from *Humicola lanuginosa* and commercially available from Novo, see also EP 341,947, is a preferred lipase for use herein. Lipase and amylase variants stabilized against peroxidase enzymes are described in WO 9414951 A to Novo. See also WO 9205249 and RD 94359044.

Peroxidase enzymes may be used as oxygen bleach activators in combination with oxygen precursors, e.g., percarbonate, perborate, hydrogen peroxide, etc., for "solution bleaching" or prevention of transfer of dyes or pigments removed from substrates during the wash to other substrates present in the wash solution. Known peroxidases include horseradish peroxidase, ligninase, and haloperoxidases such as chloro- or bromo-peroxidase. Peroxidase-containing cleaning compositions are disclosed in WO 89099813 A, October 19, 1989 to Novo and WO 8909813 A to Novo.

A range of enzyme materials and means for their incorporation into synthetic detergent compositions is also disclosed in WO 9307263 A and WO 9307260 A to Genencor International, WO 8908694 A to Novo, and U.S. 3,553,139, January 5, 1971 to McCarty et al. Enzymes are further disclosed in U.S. 4,101,457, Place et al, July 18, 1978, and in U.S. 4,507,219, Hughes, March 26, 1985. Enzyme materials useful for liquid cleaning compositions, and their incorporation into such compositions, are disclosed in U.S. 4,261,868, Hora et al, April 14, 1981. Enzymes for use in cleaning compositions can be stabilised by various techniques. Enzyme stabilisation techniques are disclosed and exemplified in U.S. 3,600,319, August 17, 1971, Gedge et al, EP 199,405 and EP 200,586, October 29, 1986, Venegas. Enzyme stabilisation systems are also described, for example, in U.S. 3,519,570. A useful *Bacillus*, sp. AC13 giving proteases, xylanases and cellulases, is described in WO 9401532 A to Novo.

Enzyme Stabilizing System

The enzyme-containing cleaning compositions herein may optionally also comprise from 0.001% to 10%, preferably from 0.005% to 8%, most preferably from 0.01% to 6%, by weight of an enzyme stabilizing system. The enzyme stabilizing system can be any stabilizing system which is compatible with the deterative enzyme. Such a system may be inherently provided by other composition actives, or be added separately, e.g., by the formulator or by a manufacturer of detergent-ready enzymes. Such stabilizing systems can, for example, comprise calcium salts, magnesium salts, boric acid, propylene glycol,

short chain carboxylic acids, boronic acids, and mixtures thereof, and are designed to address different stabilization problems depending on the type and physical form of the cleaning composition.

Stabilizing systems of certain cleaning compositions, for example automatic dishwashing compositions, may further comprise from 0 to 10%, preferably from 0.01% to 6% by weight, of chlorine bleach scavengers, added to prevent chlorine bleach species present in many water supplies from attacking and inactivating the enzymes, especially under alkaline conditions. Suitable chlorine scavenger anions are widely known and readily available, and, if used, can be salts containing ammonium cations with sulfite, bisulfite, thiosulfite, thiosulfate, iodide, etc. Antioxidants such as carbamate, ascorbate, etc., organic amines such as ethylenediaminetetracetic acid (EDTA) or alkali metal salt thereof, and mixtures thereof can likewise be used.

Polymeric Soil Release Agent

Known polymeric soil release agents, hereinafter "SRA" or "SRA's", can optionally be employed in the present cleaning compositions. If utilized, SRA's will generally comprise from 0.01% to 10.0%, typically from 0.1% to 5%, preferably from 0.2% to 3.0% by weight, of the composition.

Preferred SRA's typically have hydrophilic segments to hydrophilize the surface of hydrophobic fibers such as polyester and nylon, and hydrophobic segments to deposit upon hydrophobic fibers and remain adhered thereto through completion of washing and rinsing cycles thereby serving as an anchor for the hydrophilic segments. This can enable stains occurring subsequent to treatment with SRA to be more easily cleaned in later washing procedures. SRA's can include a variety of charged, e.g., anionic or even cationic (see U.S. 4,956,447), as well as noncharged monomer units and structures may be linear, branched or even star-shaped.

Preferred SRA's include oligomeric terephthalate esters, typically prepared by processes involving at least one transesterification/oligomerization, often with a metal catalyst such as a titanium(IV) alkoxide. Such esters may be made using additional monomers capable of being incorporated into the ester structure through one, two, three, four or more positions, without of course forming a densely crosslinked overall structure.

Suitable SRA's include: a sulfonated product of a substantially linear ester oligomer comprised of an oligomeric ester backbone of terephthaloyl and

oxyalkyleneoxy repeat units and allyl-derived sulfonated terminal moieties covalently attached to the backbone, for example as described in U.S. 4,968,451, November 6, 1990 to Scheibel and Gosselink.

SRA's also include simple copolymeric blocks of ethylene terephthalate or propylene terephthalate with polyethylene oxide or polypropylene oxide terephthalate, see U.S. 3,959,230 to Hays, May 25, 1976 and U.S. 3,893,929 to Basadur, July 8, 1975; cellulosic derivatives such as the hydroxyether cellulosic polymers available as METHOCEL from Dow; and the C₁-C₄ alkylcelluloses and C₄ hydroxyalkyl celluloses; see U.S. 4,000,093, December 28, 1976 to Nicol, et al. Suitable SRA's characterised by poly(vinyl ester) hydrophobe segments include graft copolymers of poly(vinyl ester), e.g., C₁-C₆ vinyl esters, preferably poly(vinyl acetate), grafted onto polyalkylene oxide backbones. See European Patent Application 0 219 048, published April 22, 1987 by Kud, et al. Commercially available examples include SOKALAN SRA's such as SOKALAN HP-22, available from BASF, Germany. Other SRA's are polyesters with repeat units containing 10-15% by weight of ethylene terephthalate together with 90-80% by weight of polyoxyethylene terephthalate, derived from a polyoxyethylene glycol of average molecular weight 300-5,000. Commercial examples include ZELCON 5126 from Dupont and MILEASE T from ICI.

Clay Soil Removal/Anti-redeposition Agents

The compositions of the present invention can also optionally contain water-soluble ethoxylated amines having clay soil removal and anti-redeposition properties.

A preferred soil release and anti-redeposition agent is ethoxylated tetraethylenepentamine. Exemplary ethoxylated amines are further described in U.S. Patent 4,597,898, VanderMeer, issued July 1, 1986. Also preferred are the cationic compounds disclosed in European Patent Application 111,965, Oh and Gosselink, published June 27, 1984; the ethoxylated amine polymers disclosed in European Patent Application 111,984, Gosselink, published June 27, 1984; the zwitterionic polymers disclosed in European Patent Application 112,592, Gosselink, published July 4, 1984; and the amine oxides disclosed in U.S. Patent 4,548,744, Connor, issued October 22, 1985. Other clay soil removal and/or anti redeposition agents known in the art can also be utilized in the compositions herein. See U.S. Patent 4,891,160, VanderMeer, issued January 2, 1990 and WO 95/32272, published November 30, 1995. Another type of

preferred anti-redeposition agent includes the carboxy methyl cellulose (CMC) materials.

Brightener

Any optical brighteners or other brightening or whitening agents known in the art can be incorporated at levels typically from 0.01% to 1.2%, by weight, into the cleaning compositions herein. Commercial optical brighteners which may be useful in the present invention can be classified into subgroups, which include, but are not necessarily limited to, derivatives of stilbene, pyrazoline, coumarin, carboxylic acid, methinecyanines, dibenzothiophene-5,5-dioxide, azoles, 5- and 6-membered-ring heterocycles, and other miscellaneous agents. Examples of such brighteners are disclosed in "The Production and Application of Fluorescent Brightening Agents," M. Zahradnik, Published by John Wiley & Sons, New York (1982).

Specific preferred optical brighteners useful herein are identified in U.S. Patent 4,790,856, to Wixon, issued December 13, 1988. These brighteners include the PHORWHITE series of brighteners from Verona. Other brighteners disclosed in this reference include: Tinopal UNPA, Tinopal CBS and Tinopal 5BM; available from Ciba-Geigy; Artic White CC and Artic White CWD, the 2-(4-styryl-phenyl)-2H-naphtho[1,2-d]triazoles; 4,4'-bis-(1,2,3-triazol-2-yl)-stilbenes; 4,4'-bis(styryl)bisphenyls; and the aminocoumarins. Specific examples of these brighteners include 4-methyl-7-diethyl- amino coumarin; 1,2-bis(benzimidazol-2-yl)ethylene; 1,3-diphenyl-pyrazolines; 2,5-bis(benzoxazol-2-yl)thiophene; 2-styryl-naphtho[1,2-d]oxazole; and 2-(stilben-4-yl)-2H-naphtho[1,2-d]triazole. See also U.S. Patent 3,646,015, issued February 29, 1972 to Hamilton.

Dye Transfer Inhibiting Agents

The compositions of the present invention may also include one or more materials effective for inhibiting the transfer of dyes from one fabric to another during the cleaning process. Generally, such dye transfer inhibiting agents include polyvinyl pyrrolidone polymers, polyamine N-oxide polymers, copolymers of N-vinylpyrrolidone and N-vinylimidazole, manganese phthalocyanine, peroxidases, and mixtures thereof. Any polymer backbone can be used as long as the amine oxide polymer formed is water-soluble and has dye transfer inhibiting properties. Examples of suitable polymeric backbones are polyvinyls, polyalkylenes, polyesters, polyethers, polyamide, polyimides, polyacrylates and mixtures thereof. If used, these agents typically comprise from 0.01% to 10% by

weight of the composition, preferably from 0.01% to 5%, and more preferably from 0.05% to 2%.

Chelating Agents

The cleaning compositions herein may also optionally contain one or more heavy metal chelating agents. Such chelating agents can be selected from the group consisting of amino carboxylates, amino phosphonates, polyfunctionally-substituted aromatic chelating agents and mixtures therein, all as hereinafter defined. Without intending to be bound by theory, it is believed that the benefit of these materials is due in part to their exceptional ability to remove iron and manganese ions from washing solutions by formation of soluble chelates.

Amino carboxylates useful as optional chelating agents include ethylenediaminetetracetates, N-hydroxyethylethylenediaminetriacetates, nitrilotriacetates, ethylenediamine tetrapropionates, triethylenetetraamine-hexacetates, diethylenetriaminepentaacetates, and ethanoldiglycines, alkali metal, ammonium, and substituted ammonium salts therein and mixtures therein.

Amino phosphonates are also suitable for use as chelating agents in the compositions of the invention when at least low levels of total phosphorus are permitted in cleaning compositions, and include ethylenediaminetetrakis (methylenephosphonates) as DEQUEST.

Polyfunctionally-substituted aromatic chelating agents are also useful in the compositions herein. See U.S. Patent 3,812,044, issued May 21, 1974, to Connor et al. Preferred compounds of this type in acid form are dihydroxydisulfobenzenes such as 1,2-dihydroxy-3,5-disulfobenzene.

A preferred biodegradable chelator for use herein is ethylenediamine disuccinate ("EDDS"), especially the [S,S] isomer as described in U.S. Patent 4,704,233, November 3, 1987, to Hartman and Perkins; also preferred are water-soluble methyl glycine diacetic acid (MGDA) salts (or acid form) as a chelant or co-builder useful with, for example, insoluble builders such as zeolites, layered silicates.

If utilized, these chelating agents will generally comprise from 0.1% to 15% by weight of the cleaning compositions herein. More preferably, if utilized, the chelating agents will comprise from 0.1% to 3.0% by weight of such compositions.

Alkoxyated Polycarboxylates

Alkoxylated polycarboxylates such as those prepared from polyacrylates are useful herein to provide additional grease removal performance. Such materials are described in WO 91/08281 and PCT 90/01815 at p. 4 et seq., incorporated herein by reference. Chemically, these materials comprise polyacrylates having one ethoxy side-chain per every 7-8 acrylate units. The side-chains are of the formula $-(CH_2CH_2O)_m(CH_2)_nCH_3$ wherein m is 2-3 and n is 6-12. The side-chains are ester-linked to the polyacrylate "backbone" to provide a "comb" polymer type structure. The molecular weight can vary, but is typically in the range of 2000 to 50,000. Such alkoxylated polycarboxylates can comprise from 0.05% to 10%, by weight, of the compositions herein.

Other Ingredients

A wide variety of other ingredients useful in cleaning compositions can be included in the compositions herein, including other active ingredients, carriers, hydrotropes, processing aids, etc. If high sudsing is desired, suds boosters such as the C₁₀-C₁₆ alkanolamides can be incorporated into the compositions, typically at 1%-10% levels. The C₁₀-C₁₄ monoethanol and diethanol amides illustrate a typical class of such suds boosters. If desired, water-soluble magnesium and/or calcium salts such as MgCl₂, MgSO₄, CaCl₂, CaSO₄, can be added at levels of, typically, 0.1%-2%, to provide additional suds and to enhance grease removal performance.

Other preferred optional deterative ingredients useful herein include those commonly used in cleaning compositions for enhancing aesthetic characteristics, such as dyes, pigments, perfumes, and emulsifiers. Also useful herein are fabric softeners, suds suppressers, structurants, binders, bleach catalysts, and/or other compounds known in the art.

Fig. 1 shows a package, 1, having separate chambers, 2. The outer seal, 3, runs along the outside edge of the package, 1, while a breaking seal, 4, separates the package, 1, into separate chambers, 2. Breaking seal, 4, is weaker than outer seal, 3, so as to allow the contents of the separate chambers, 2, to be commingled by using pressure to cause the breaking seal, 4, to give way, thereby creating one large chamber from the two separate chambers, 2. When this is done, the contents of the separate chambers, 2, will commingle and form the active bleaching mixture. The commingling can be enhanced by, for example, shaking, squeezing, or agitating the package. Fig. 1 also shows a

perforation, 5, at which the package, 1, can be torn and/or cut so as to allow the contents thereof to be dispensed.

Fig. 2 is a cross-sectional view of Fig. 1 as seen along line 1-1. Fig. 2 shows that the package, 1, is constructed of a top layer, 10, and a bottom layer, 11. The top layer, 10 and the bottom layer, 11, are each made of an outer layer, 12, which is lined by an inner laminate layer, 13. Breaking seal, 4, is formed by a film, 6, which has a strong adhesive on one side, and a weaker adhesive on the other. The film, 6, forms the breaking seal, 4, by fastening the laminate layer, 13, of the top layer, 10 to the laminate layer, 13, of the bottom layer, 11, to form the substantially water and non-aqueous solvent-tight breaking seal, 4. The outer seal, 3, is formed along the perimeter by sealing the laminate layers, 13, together.

Fig. 3 shows a triple chamber embodiment having separate chambers, 2, separated by breaking seals, 4. The breaking seals, 4, are weaker than the outer seal, 3, and are formed by heat-sealing. Outer seal, 3, is formed so as to provide a spout, 15, from which the contents of the package, 1, can be dispensed, for example, by tearing along line 2-2, via perforation, 5.

Fig. 4 shows a triple chamber embodiment having separate chambers, 2, separated by breaking seals, 4, and non-breaking seal 20. Non-breaking seal, 20, is stronger than the breaking seal, 4. Outer seal, 3, is formed so as to provide a spout, 15, from which the contents of the package, 1, can be dispensed, for example, by cutting along line 3-3.

Examples of the invention are set forth hereinafter by way of illustration and are not intended to be in any way limiting of the invention.

EXAMPLE 1

In a preferred dual chamber embodiment, the aqueous component chamber contains as its primary components, by weight: 50% moisture, 44% surfactant and builder, and 6% hydrogen peroxide as an active oxygen source, while the non-aqueous component chamber contains by weight, 87% glycerol as a non-aqueous solvent, 3% NOBS as a bleach activator, and 10% sodium bicarbonate as an alkalinity source.

The package is made as two separate chambers having an adjoining partition. Two sheets of laminated nylon are heat-sealed at the edges. The adjoining partition is a breaking seal made of a contact adhesive film having a strong adhesive and a weak adhesive on opposite sides thereof. The adjoining

partition is placed between the two nylon sheets to form a substantially water-tight and solvent-tight seal. The volume ratio of the aqueous component chamber and the non-aqueous component chamber is about 1:1.

When the contents of the aqueous component chamber are squeezed, the
5 breaking seal is broken and the contents of the aqueous component chamber and the non-aqueous component chamber commingle and form an activated bleach mixture having an available peroxyacid oxygen level of at least 200 ppm. The activated bleach mixture is then used in a cleaning application.

EXAMPLE 2

10 In a preferred dual chamber embodiment, a non-aqueous detergent paste is made by homogenizing in a blender the following ingredients: 60% base detergent powder, 10% alkalinity source, 5% nonionic surfactant, 5% of polyethylene glycol (molecular weight of about 300), 0.1% suds supressor, 4.9% bleach activator, and 15% glycerol. This paste is sealed into a non-aqueous
15 component chamber.

The aqueous component contains a 6% solution of hydrogen peroxide. The aqueous component is sealed into an aqueous component chamber.

The two separate chambers are not connected. To use, the contents of the non-aqueous component chamber are poured into the aqueous component
20 chamber, and an available peroxyacid oxygen of greater than 400 ppm is formed therein. The activated bleach mixture is then added to the wash cycle of a laundry application.

EXAMPLE 3

In a preferred triple chamber embodiment, a non-aqueous detergent paste
25 is made as described in Example 2, except that the bleach activator is not added thereto.

The aqueous component is made by making a 6% by weight solution of hydrogen peroxide. This is sealed into a first aqueous component chamber. A second aqueous component is made by preparing a mixture of 15% bleach
30 activator (TAED) in distilled water. This is sealed into a second aqueous component chamber.

The separate chambers are made as described in Example 1, except that there are three adjoining chambers as described in Fig. 4. The volume ratio of the non-aqueous component chamber to first aqueous component chamber to
35 second aqueous component chamber is about 8.5:2:1. The activated bleach

mixture is made and used as a pre-treater in a laundry application. To dispense, a clamp is attached to the end of the package opposite the spout. The spout is then cut open. The flexible package is then rolled around the clamp so that the package contents are forced out of the spout.

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EXAMPLE 4

A preferred dual chamber embodiment is made as in Example 1, except that 3% TAED is used as a bleach activator.

EXAMPLE 5

10 A preferred triple chamber embodiment is made as in Example 3, except that perborate is used in place of hydrogen peroxide, and instead of being placed in the first aqueous component chamber, the perborate is placed in the non-aqueous component chamber. Conversely, the alkalinity source is removed from the non-aqueous component chamber and placed in the first aqueous component chamber.

15

The separate chambers are made as in Example 4, except that the outer seal and the non-breaking sea are ultrasonically sealed.

WHAT IS CLAIMED IS:

1. A method for making and using an activated bleach mixture comprising the steps of:
 - a. providing a plurality of separate chambers comprising:
 - i. an aqueous component chamber comprising from about 10% to about 90% moisture and an aqueous component; and
 - ii. a non-aqueous component chamber comprising a non-aqueous solvent and a non-aqueous component, wherein the separate chambers maintain the contents of the aqueous component chamber and the non-aqueous component chamber in a substantially unmixed state;
 - b. providing an alkalinity source; and
 - c. making an activated bleach mixture by commingling the contents of the aqueous component chamber, the non-aqueous component chamber, and the alkalinity source, wherein the activated bleach mixture generates an available peroxyacid oxygen level of at least about 200 ppm.
2. The method of Claim 1 wherein:
 - a. the aqueous component comprises an active oxygen source; and
 - b. the non-aqueous component comprises an oxygen bleach activator.
3. The method of Claim 1 wherein:
 - a. the aqueous component comprises an oxygen bleach activator; and
 - b. the non-aqueous component comprises an active oxygen source.
4. The method of Claim 1 further comprising the steps of:
 - a. providing a surfactant component; and
 - b. making an activated bleach mixture by commingling the contents of the aqueous component chamber, the non-aqueous component chamber, the alkalinity source, and the surfactant component.

5. The method of Claim 4 wherein the surfactant is selected from the group consisting of amphoteric surfactants, anionic surfactants, cationic surfactants, nonionic surfactants, zwitterionic surfactants, and mixtures thereof.
- 5 6. A method for making and using an activated bleach mixture comprising the steps of:
- 5 a. providing a plurality of separate chambers comprising:
- 5 i. an aqueous component chamber comprising from about 10% to about 90% moisture and an aqueous component;
- 5 ii. a non-aqueous component chamber comprising a non-aqueous solvent and a non-aqueous component; and
- 10 iii. a surfactant component chamber comprising a surfactant component,
- 10 wherein the separate chambers maintain the contents of the aqueous component chamber, the non-aqueous component chamber, and the surfactant component chamber in a substantially unmixed state;
- 15 b. providing an alkalinity source; and
- 15 c. making an activated bleach mixture by commingling the contents of the aqueous component chamber, the non-aqueous component chamber, and the surfactant component chamber, and the alkalinity source, wherein the activated bleach mixture generates an available peroxyacid oxygen level of at least about 200 ppm.
- 20 7. A kit for making an activated bleach mixture comprising:
- a. a plurality of separate chambers, comprising:
- 5 i. an aqueous component chamber comprising from about 10% to about 90% moisture and an aqueous component; and
- 5 ii. a non-aqueous component chamber comprising a non-aqueous solvent and a non-aqueous component; and
- b. an alkalinity source,
- 10 wherein the aqueous component and the non-aqueous component remain in a substantially unmixed state, and wherein when commingled, the

contents of the aqueous component chamber, the non-aqueous component chamber, and the alkalinity source make an activated bleach mixture having an available peroxyacid oxygen level of at least about 200 ppm.

15

8. The kit of Claim 7 wherein the separate chambers are made from nylon laminated with a polyethylene film.
9. The kit of Claim 7 further comprising a surfactant component.
10. The kit of Claim 9 wherein the separate chambers further comprise a surfactant component chamber, wherein the surfactant component remains in a substantially unmixed state within the surfactant component chamber, and wherein when commingled, the contents of the aqueous component chamber, the non-aqueous component chamber, and the surfactant component chamber, and the alkalinity source make an activated bleach mixture having an available peroxyacid oxygen level of at least 200 ppm.

5

1/2

FIG. 1

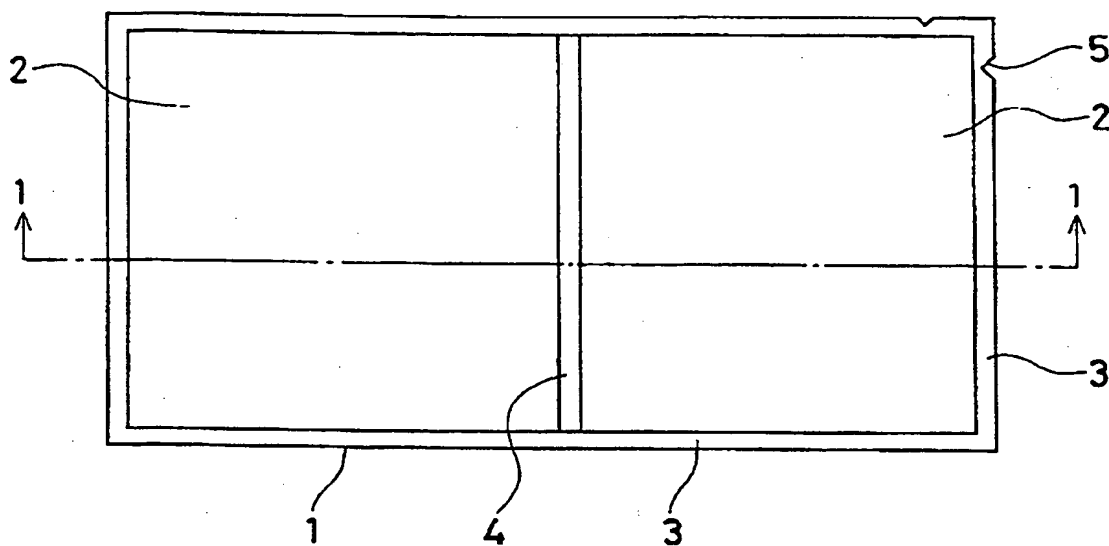
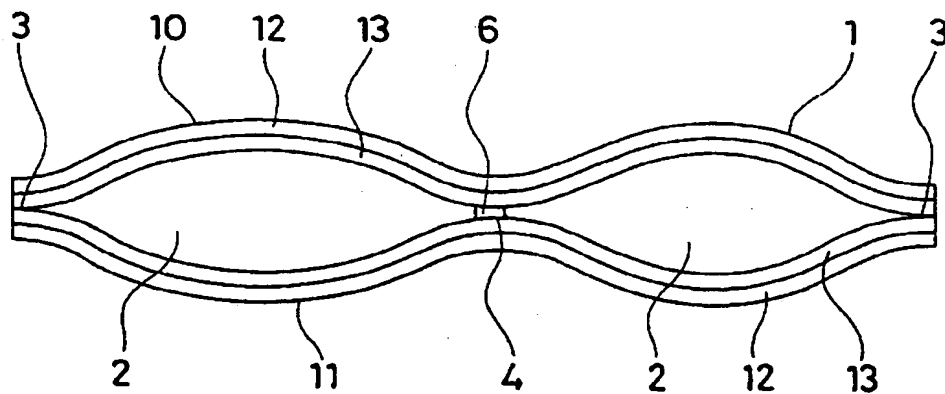


FIG. 2



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FIG. 3

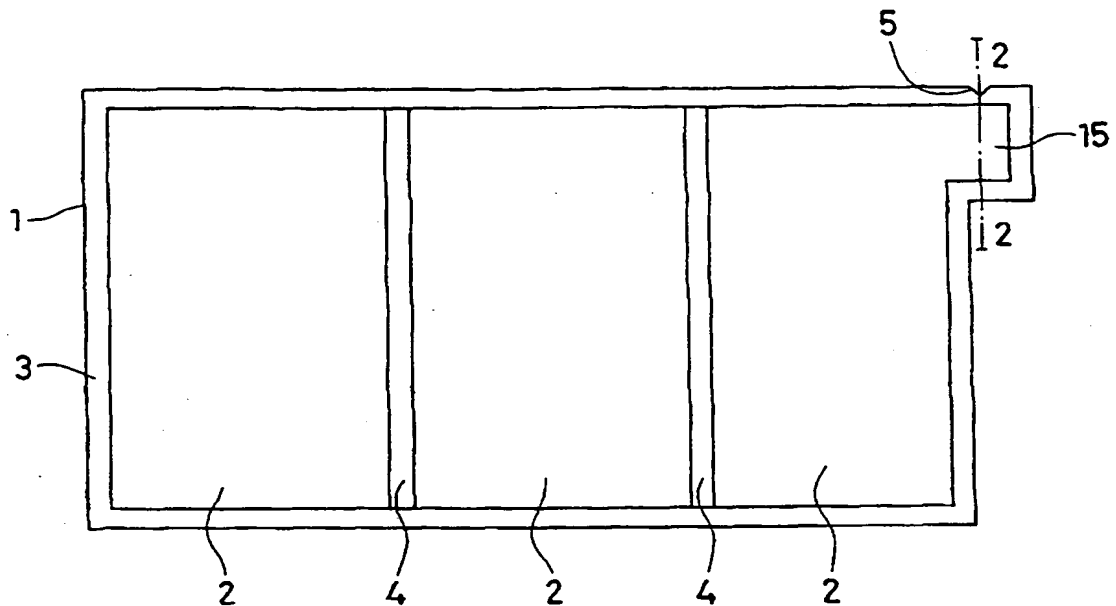
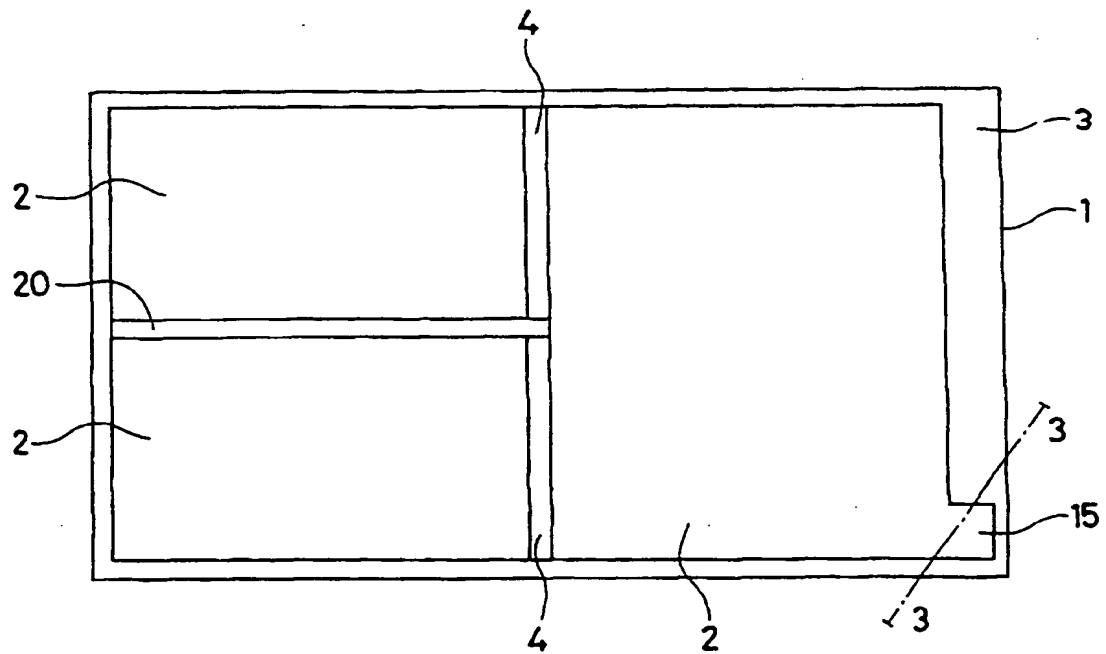


FIG. 4



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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 97/23480

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 C11D17/04 C11D3/39

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 C11D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 31087 A (CLOROX CO) 28 August 1997 see page 19, line 3 - line 16; claims; examples 1,2; tables 1,2	1-7,9,10
A	EP 0 744 462 A (CLOROX CO) 27 November 1996 see page 6, line 1 - line 8 see page 10, line 46 - page 11, line 15 see page 16, line 57 - page 17, line 16 see claims 28-42; examples 15,16; table 1	1-7,9,10
A	EP 0 414 462 A (UNILEVER PLC ; UNILEVER NV (NL)) 27 February 1991	1-10
A	WO 97 45519 A (WARWICK INT GROUP ; TURNER NEIL A (GB); TOMPSETT STEPHEN JAMES (GB)) 4 December 1997 see page 6, line 12 - line 14; claims 5,8	1-7,9,10
-/--		

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

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INTERNATIONAL SEARCH REPORT

In International Application No
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